4K96-32

An Estimate of Spiridon Lake Sockeye Salmon Commercially Harvested Within the Northwest Kodiak and Southwest Kodiak Districts, 1995

By
Patricia A. Nelson
and
Charles O. Swanton

Regional Information Report[1] No. 4K96-32

Alaska Department of Fish and Game
Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, Alaska 99615

May 1996

[1]The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Commercial Fisheries Management and Development Division.

ACKNOWLEDGMENTS

The Kodiak Regional Aquaculture Association provided funding for this project. Kodiak area field staff were responsible for data collection. Spiridon Lake project leader Steve Schrof and field crew collected terminal fishery data. Special thanks to Chris Hicks and Chris Anderson for their efforts in Kodiak catch sampling, and Mark Witteveen for scale age classification and measurement assistance. Lucinda Neel contributed publication expertise. Additional editing was provided by Dan Urban, Ivan Vining, Dave Prokopowich, and Steve Honnold.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

Spiridon Lake, located in the Central Section of the Northwest (NW) Kodiak District, is the third largest lake (9.6 km long, 1.6 km maximum width) on Kodiak Island (Figures 1 and 2). Prior to 1991, a series of barrier falls prevented access to the lake outlet and precluded the presence of anadromous fish (Kyle et al. 1990). Introduction of sockeye salmon *Oncorhynchus nerka* fry to this system coupled with the construction of a smolt bypass system has resulted in an artificial run which contributed an estimated 263,750 fish to the Kodiak Management Area commercial sockeye catch in 1994 (Nelson and Barrett 1994). An estimated 99% of these fish were caught in the NW Kodiak District. Stock contribution estimates were generated using visual identification of a consistent and easily distinguishable age 1.2 freshwater scale pattern. The timing of the 1994 Spiridon sockeye salmon run (along Kodiak Island's westside) peaked in mid August.

The 1994 run reconstruction estimates, 1990 and 1991 brood year smolt data, and brood stock sibling relationships, were used to derive a 1995 preseason forecast of 160,000 (range 75,000 to 250,000) fish. The relationship between age 1.2 and 1.3 siblings from the parent stock (Upper Station late run) indicated that the primary age class would be age 1.3 (62%; Geiger and Simpson 1995).

In accordance with the State Board of Fisheries (BOF) adopted management plan, the Spiridon Lake sockeye run is intended to be harvested in traditional commercial fishing areas of the Northwest Kodiak District during openings directed on local stocks (ADF&G 1994). The remainder is to be taken in an exclusive purse seine and beach seine special harvest area in Telrod Cove within Spiridon Bay (Figure 3).

Multiple stocks migrate along the westside of Kodiak Island with similar run timing to the introduced Spiridon Lake stock. They include Ayakulik, Karluk and Upper Station late runs (Barrett and Nelson 1994). Run reconstruction programs have been developed and modified for these stocks since 1985. Accurate assignment of catches to stock of origin is necessary for evaluation of productivity trends, estimates of smolt-to-adult survival, return-per-spawner relationships, and preseason forecasting. In order to maintain consistency in run reconstruction programs for wild stocks and quantify returns from the Spiridon Lake enhancement project, a comprehensive catch apportionment project was necessary. Scale pattern analysis along with visual identification of freshwater growth patterns were employed in 1995 to estimate the Spiridon Lake sockeye contribution to the Northwest and Southwest Kodiak Districts' commercial catches.

This report serves as the second in a series of annual run reconstruction estimates of Spiridon Lake sockeye salmon.

METHODS

Escapement Sampling

Sockeye escapements were sampled weekly for age (scales) at weir sites in the Kodiak Management Area (KMA; ADF&G 1995). These systems include Karluk, Ayakulik (Red Lake), Frazer, and Upper Station systems. Terminal catches were sampled weekly in the Spiridon Bay Special Harvest Area at Telrod Cove (SBSHA; statistical area 254-50; Figure 3) and were assumed to represent Spiridon escapement. The targeted sample size was 240 fish per system per week (Swanton and Nelson 1994).

Commercial Catch Sampling

During July and August, commercial sockeye catches from the following areas within the Northwest and Southwest Kodiak Districts were sampled weekly for age with a targeted sample size of 600 fish per area (Swanton and Nelson 1994):

Northwest Kodiak District (Figure 2)
- Central Section
  - Uyak Bay (Statistical Areas 254-10 through 254-40), and
  - Uganik Bay (Statistical Areas 253-11 through 253-35);

Southwest Kodiak District (Figure 4)
- Inner and Outer Karluk Sections (Statistical Areas 255-10 and 255-20),
- Halibut Bay Section (Statistical Areas 256-25 and 256-30), and
- Inner and Outer Ayakulik Sections (Statistical Areas 256-10 and 256-20).

Age Designation of Escapement and Catch Samples

Scales were collected from the preferred area following procedures outlined in INPFC (1963) and mounted on gum cards. Impressions were made on cellulose acetate (Clutter and Whitesel 1956) and fish ages were assigned by examining scale impressions for annual growth increments using a microfiche reader fitted with a 48X lens following designation criteria established by Mosher (1968). Ages were recorded on sampling forms using European notation (Koo 1962). Age composition estimates from stock specific escapements and catch by area were interpolated daily and summarized weekly (Blackburn 1993).

Stock Selection and Commercial Catch Areas Evaluated

Selection of the sockeye stocks to include in this analysis were based on historic run timing within the commercial catch areas of interest (Barrett and Nelson 1994), and evaluation of the 1995 age composition estimates post-14 July from both escapements and catches. Systems considered were

those with an age 1.2 escapement component of greater than 10% within any given week (post-14 July), coupled with run timing that would dictate presence within the harvest area. Non-local sockeye stocks or stock complexes from adjoining management areas (Upper Cook Inlet and Chignik) were evaluated based upon the same criteria as local stocks.

The areas and time frame considered for this study (NW and SW Kodiak Districts; post-14 July) were determined by evaluating the likely migration corridor and run timing for the Spiridon stock based on the brood source (Upper Station late run; Tyler et al. 1986; Barrett and Nelson 1994). The Southwest Kodiak District was included for the 1995 season based on a minor percentage of Spiridon fish observed in this district during 1994 (Nelson and Barrett 1994).

Stock Identification Using Visual Recognition of Scale Growth Characteristics

Age 1.1 freshwater growth characteristics of sockeye scales from the SBSHA were used as a stock specific template to classify fish of this age class from the commercial catches (Spiridon or non-Spiridon). The freshwater characteristics used included number of circuli, distance between circuli, and total size of the freshwater growth zone (Nelson and Barrett 1994). Visual scale pattern identification was also employed for estimating the stock contribution of age 1.2 fish during the period 19-25 July within both the Uganik and Uyak Bay harvest areas because small sample sizes prohibited the use of scale pattern analysis. Images of age 1.1 and 1.2 scales from the stocks considered are included for comparative purposes (Appendix A.1-6).

Scale Pattern Analysis and Stock Composition Estimation

Maximum sample sizes of 200 scales were selected for establishing standards for known stocks (Cook 1982). Standards (knowns) for the Spiridon Lake stock were selected from terminal area catch samples collected from 26 July through 29 August. Samples for the Ayakulik standard were selected from escapement scales collected between 21 June and 29 August and the Upper Station late run standard constructed from samples collected from 5 July to 5 September. In the case of both Ayakulik and Upper Station standards, measurements prior to 14-July were made in an attempt to satisfy sample size requirements

Weekly, a minimum of 30 and a maximum of 100 scales from selected commercial fishing areas were sought for measurement. Scale measures were obtained by starting with the first age 1.2 scale within the sample and continuing until all age 1.2 scales suitable for measurement had been exhausted or the sample size was met.

Scale measurement data were collected using the Biosonics optical pattern recognition system (OPRS), which integrates a compound microscope, ocular lens, frame grabber, digitizing tablet, and microcomputer. Scale-data collection procedures consisted of (1) establishing a horizontal reference line below the scale focus through the reticulated region; (2) identifying the center of the scale focus or measurement initiation point; (3) measuring incremental distances from scale focus to each circuli within the first freshwater annular zone off an axis perpendicular to the

reference line (Narver 1963); and (4) saving measured data to a unique computer file. All scale measurements were specific to a single age class (age 1.2) and were collected at about 200X magnification. Scales with poorly defined images and those collected from a non-preferred region (Clutter and Whitesel 1956) were not measured.

Raw OPRS scale measures were transformed into individual variable format for both standard and unknown files using a BASIC program, REFORM1 (written by Larry Greer, ADF&G, Kodiak, AK). Variables constructed were circuli counts (C.C.) and incremental distances (I.D.) which start at the scale focus and end with the last circulus of the first freshwater annulus. These variables reflect the growth that occurred during the freshwater phase (lake residence) of each stock's life history. The maximum number of variables available for model development was constrained to the fewest number of circuli counted on any of the stocks included (e.g., if a stock had one scale with only 10 circuli, then the maximum number of potential variables describing the freshwater growth of that stock would be 11; one circuli count variable and 10 incremental distance variables).

The objective of using scale pattern analysis (SPA) is to develop a statistical model that accurately identifies individual scales from known stocks within mixed stock fisheries or unknown samples. A quadratic discriminant function was employed for classifying unknown samples to stock of origin (Dillon and Golstein 1984). Assumptions associated with using both SPA and the quadratic function were (1) all probable stocks contributing to the commercial fishery samples are represented in the model; and (2) scale variables from each stock were multivariate normal. Evaluation of univariate normality was assessed using frequency histograms for all variables of each stock considered. All variables assumed normal in distribution were subjected to a stepwise variable selection procedure ($\alpha = 0.1$; SAS Institute, 1987) for identifying variables with large discriminant weight. Accuracy of a model in correctly classifying individuals to actual stock of origin was determined by the "leaving-one-out" approach of Lachenbruch (1967). Models were also constructed using an all variable forced approach (Davis 1987; Swanton 1992) and compared to variable-selected models. Choice of a model (variable selected or variable forced) for classifying unknown samples was based on correct classification accuracy (Habbema and Hermans 1977). Stock composition estimates for unknown samples (by area and time period) were corrected for misclassification error using the matrix correction approach of Cook and Lord (1978), with 90% confidence coefficients calculated using the variance formula of Pella and Robertson (1979). Confidence coefficients for the three stock model were generated assuming a chi-square distribution. All discriminant modeling was completed using PROC DISCRIM (SAS Institute 1987).

Catch Assignment

Catch numbers by area were obtained from the Alaska Department of Fish and Game (ADF&G) fish ticket database on 15 October 1995. Harvest estimates for statistical area 254-50 (SBSHA) were not consistent with onsite observations by ADF&G field personnel. Adjustments were made to reported catches (D. Prokopowich, ADF&G, Kodiak, Personal Communication) by reassigning a portion of the catches reported in statistical area 254-40 to statistical area 254-50. Apportionment of the commercial

catch by week within the aforementioned commercial fishing areas was accomplished by multiplying the catch of an age class (either age 1.1 or 1.2 fish) for a given week by the estimated proportion (by either the visual identification or SPA method) of Spiridon Lake sockeye of that age class.

RESULTS

Age Composition Estimates of Escapements and Catches

Primary age classes of the Karluk sockeye escapement post-14 July included age 2.2, 2.3, and 3.2 fish (Table 1). Karluk late run is a substantial contributor to westside Kodiak catches during July and August (Barrett and Nelson 1995), however based on escapement age composition estimates, it was not contributing to the age 1.2 component of the catch. Because age 1.2 sockeye represented less than 2.0% of the escapement, Karluk was not included in the analyses. Age composition estimates of Ayakulik (Red River) sockeye escapement post-14 July consisted of age 1.2, 2.2, and 2.3 fish (Table 2). The overall age 1.2 component was less than 10%, however it was greater than 10% during 3 sampling periods, thus Ayakulik was included in the analyses. The dominant age classes contributing to the Frazer Lake escapement were age 2.1, 2.2, 2.3, and 3.2 (Table 3). Age 1.2 fish contributed less than 1.0%, therefore this stock was excluded from the analyses. The Upper Station late run was composed of four age classes (0.2, 0.3, 1.2, 2.2) that represented 89% of the sockeye escapement (Table 4). Age 1.2 fish represented 10.9% (3.0%-17.8%) of the escapement post-14 July and were included in the analyses. After evaluation, non-local stocks were deemed to be improbable contributors and excluded from further consideration.

Of the 2,103 scales collected from the Uganik area post-14 July 1995, five age classes (age 1.2, 1.3, 2.2, 2.3, and 3.2) composed greater than 90% of the catch (Table 5). For the Uyak commercial catch area, 3,319 fish were sampled, and age 1.2, 1.3, 2.2, 2.3, and 3.2 fish represented 93.0% of the commercial sockeye catch post-14 July (Table 6). Harvests within the SBSHA were composed of four age classes (age 1.1, 1.2, 1.3, and 2.2) that represented 96.6% of the catch; age 1.1 and 1.2 sockeye salmon contributed 19.9% and 60.2%, respectively (Table 7).

Visual Identification

The freshwater scale pattern of age 1. Spiridon Lake sockeye salmon observed in 1995 was similar to the age 1. scale pattern used for visual identification in 1994. The number of freshwater circuli was large (greater than 15) as were the total freshwater distances. No other local or non-local sockeye stocks screened (age 1.1 or 1.2) approximated this freshwater growth pattern. We are confident that when small sample sizes prohibited the use of scale pattern analysis, the visual identification method was accurate in classifying age 1.1 (7/19-9/05) and 1.2 (7/19-7/25) fish from the Uganik and Uyak catches.

An estimated 5,250 Spiridon fish (age 1.1) were harvested in the Uganik Bay catch area from 19 July through 5 September with estimates ranging from 100% (26 July-1 August) to 40% (30

August- 5 September; Table 8). During this time period, a similar trend was evident within the Uyak Bay catch, with an age 1.1 contribution estimate of 4,551 fish.

Stock Separation Model

All scale measurement variables were approximately univariate normal for each of the three stocks. The variables providing the greatest discriminant weight were circuli counts and the 5th, 6th, and 8th incremental distance measures (Appendix B.1.). The mean number of freshwater circuli for Spiridon was 20 (SE = 0.12), while Ayakulik and Upper Station were similar with 12.7 (SE = 0.14) and 12.9 (SE = 0.18) respectively. The all variable forced quadratic discriminant model performed better (mean classification accuracy 82.4%) than the variable selected model (using the circuli count and 5th, 6th and 8th incremental distance variables) which had a mean classification accuracy of 77.3%. Therefore, a three stock model (Spiridon Lake, Ayakulik, and Upper Station late run) was developed which included 200 age 1.2 scales measured from Spiridon, 186 from Ayakulik, and 102 scales from Upper Station late run. The overall mean classification accuracy was 82.4% for the three stock model with individual classification accuracy's ranging from 97% (Spiridon) to 72.0% (Ayakulik; Table 9). There was almost perfect balance in misclassification error between Ayakulik and Upper Station at 25%.

Stock Composition Estimates

Stock composition estimates derived for the Uganik harvest area spanned the time period 19 July through 5 September (Table 10). Visual identification rather than scale pattern analysis was employed for the first week when the minimum sample size of age 1.2 scales was not achieved. During this period, the estimated contribution of Spiridon origin sockeye was 31.3%. No estimates of either Ayakulik or Upper Station late run sockeye were generated for this weekly period. The age 1.2 scale samples available during 26 July through 15 August were also limited in number and a pooled estimate was generated. The stock composition estimates were 82.6% Spiridon (range 66.2% to 99.0%), 17.4%Ayakulik (± 25.2), and 0.0% (range zero to 9.8%) Upper Station late run fish (Table 10). For the period 16-29 August sample size problems were again encountered, so pooling was applied. The age 1.2 stock composition for this catch period was 82.4% (±13.5%) Spiridon, 14.8% (± 18.4%)Ayakulik, and 2.7% (±14.5%) Upper Station late run sockeye.

Stock composition estimates for the Uyak harvest area closely mirrored those for Uganik (Table 10). In the first period (19-25 July) visual identification was employed. The proportion of Spiridon age 1.2 sockeye at 33.3% was almost identical to that of Uganik. The age 1.2 scales available for measurement during 26 July-8 August were limited and a pooled estimate was generated. Stock specific proportions were: 84.1% (range 71.6% to 96.6%) Spiridon, 9%Ayakulik (±16.1%), and 6.7% (±14.6%) Upper Station late run. The stock proportions changed little during the next two weeks (week ending dates 15 and 22 August) with the Spiridon and Ayakulik sockeye stock's contributions increasing slightly and Upper Station estimated contribution decreasing. A pooled estimate for the last two weeks (23-29 August and 30 August-

5 September) showed the Spiridon Lake contribution to be 74.2% (± 16.2%). Ayakulik remained static at 10%, and the late run Upper Station stock increased to 15.8% of the age 1.2 sockeye salmon harvested.

Estimated Spiridon Sockeye Salmon Catch and Run Timing

In 1995, a total of 533,234 sockeye salmon were harvested in the Northwest Kodiak District post-14 July. An estimated 18.1% (96,705) were of Spiridon Lake origin (Figure 5). Of this total, 35,209 fish (36.4%) were caught within the Uganik area, 31,692 (32.8%) from the SBSHA, and 29,804 (30.8%) within the Uyak harvest area (Table 11; Figure 6).

Peak run timing based on commercial catches varied by area, with peak catches occurring from 2-8 August in Uyak Bay , 9-15 August in the SBSHA, and 23-29 August in Uganik Bay (Table 11; Figure 7). For the NW Kodiak District (all areas combined), the largest catches of Spiridon sockeye were attained during 9-22 August (Figure 8).

Catches in the Southwest Kodiak District were not sampled frequently enough post-14 July to determine the contribution of Spiridon Lake sockeye. However, based on limited scale samples, the Spiridon sockeye contribution appeared to be negligible.

DISCUSSION

The sibling relationship (age 1.2 to 1.3) used for the 1995 preseason forecast of Spiridon Lake sockeye salmon does not appear to be consistent with the brood stock source. The Upper Station late run age 1.2 to 1.3 sibling relationship has, in the past, been fairly accurate (R^2= 0.378, N=11) at predicting the subsequent year's return of age 1.3 sockeye to this system. Therefore, it seemed reasonable that this relationship would hold for the introduced Spiridon Lake sockeye run, however 1995 data represents the second year of substantial age 1.2 adult returns from this enhancement project. Several more years of return data from this project are required before any additional insight with regards to ocean age of Spiridon Lake sockeye can be made.

Run timing of the Spiridon Lake stock appears to be very similar to the run timing of the Upper Station late run (Figure 8). During both 1994 and 1995, peak catches correspond to timing of the brood stock source . Catch estimates from 1994 and 1995 suggest that a majority of this run migrates from north to south along Kodiak Islands westside. This is consistent with what Barrett and Nelson (1994) reported, as well as results from recent tagging experiments (Tyler et al. 1986). There does not appear to be any evidence that would support there being other than minor contributions of Spiridon sockeye salmon to the catches within the Southwest Kodiak District. Therefore, it is our intent to provide only minimal scrutiny of the catches in this harvest area in the future.

The estimated 96,705 fish harvest of Spiridon origin sockeye salmon is a minimum number. This stock may have contributed to other Kodiak area fisheries outside the NW Kodiak and SW Kodiak Districts,

specifically the SW Afognak Section. An attempt will be made during the 1996 season to secure samples from this section during mid-July and August to determine the extent of this potential contribution. Although fishing continued within the Uganik and Uyak Bay catch areas post-05 September, catches were minimal and it is our opinion that the unestimated catch of Spiridon sockeye was probably negligible relative to the numbers presented within this report.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1994. 1994 Cook Inlet/Kodiak/Chignik Commercial Fishing Regulations. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Juneau.

ADF&G (Alaska Department of Fish and Game). 1995. Kodiak Management Area Salmon Research Operational Plans for 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K95-37, Kodiak.

Barrett, B.M. and P.A. Nelson. 1994. Estimated run timing of selected sockeye salmon stocks on the west and east sides of Kodiak Island. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K94-6, Kodiak.

Barrett, B.M. and P.A. Nelson. 1995. Estimation of Karluk Lake early and late run sockeye returns based on scale age data, 1985-1994. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K95-44, Kodiak.

Blackburn, J. 1993. Documentation for the application redage. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, (Region IV unpublished report), Kodiak

Clutter, R. and L. Whitesel. 1956. Collection and Interpretation of sockeye salmon scales. International Pacific Salmon Fisheries Commission, Bulletin 9, New Westminster, British Columbia, Canada.

Cook, R.C. 1982. Estimating the mixing proportion of salmonids with scale pattern recognition applied to sockeye salmon (Oncorhynchus nerka) in and around the Japanese landbased drift net fishery area. Ph.D. Dissertation, Univ. Washington, Seattle. 264pp.

Cook., R. C., and G. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon by evaluating scale patterns with a polynomial discriminant method. Fisheries Bulletin 76(2):415-423.

Davis, N. D. 1987. Variable selection and performance of variable subsets in scale pattern analysis. Report submitted to INPFC 1987. Fisheries Research Institute, University of Washington, Seattle.

Dillon, W.R. and M. Goldstein. 1984. Multivariate analysis: Methods and applications. John Wiley and Sons Publisher, New York.

LITERATURE CITED (Cont.)

Geiger, H.J. and E. Simpson. 1995. Preliminary run forecasts and harvest projections for 1995 Alaska salmon fisheries and review of the 1994 season. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 5J95-01, Juneau.

Habbema, J.D.F. and J. Hermans. 1977. Selection of variables in discriminant analysis by F-statistic and error rate. Technometrics Vol. 19 (4).

INPFC (International North Pacific Fisheries Commission). 1963. Annual Report 1961. Vancouver, British Columbia, Canada.

Koo, T.S.Y. 1962. Studies of Alaska red salmon. University of Washington, Publications in Fisheries, New series, Volume I. Seattle.

Kyle, G.B., L.E. White, and J.P. Koenings. 1990. Limnological and fisheries assessment of the potential production of sockeye salmon (Oncorhynchus nerka) in Spiridon Lake. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development, Report 108, Juneau.

Lachenbruch, P.A. 1967. An almost unbiased method of obtaining confidence intervals for the probability of misclassification in discriminant analysis. Biometrics 23 (4):635-645.

Mosher, K. H. 1968. Photographic atlas of sockeye salmon scales. Bureau of the U.S. Fish and Wildlife Service. Fishery Bulletin 67(2):243-280.

Narver, D.W. 1963. Identification of adult red salmon groups by lacustrine scale measurement, time of entry, and spawning characteristics. Masters Thesis, University of Washington, Seattle.

Nelson, P.A., and B.M. Barrett. 1994. An estimate of the number of Spiridon Lake Sockeye salmon commercially harvested within the Northwest Kodiak and Southwest Kodiak Districts, 1994. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K94-43, Kodiak.

Pella, J.J., and T.L. Robertson. 1979. Assessment of composition of stock mixtures. Fisheries Bulletin 77(2):387-398.

SAS Institute. 1987. SAS/STAT guide for personal computers, Version 6. SAS Institute Inc. Cary, North Carolina.

Swanton, C.O. 1992. Stock Interrelationships of sockeye salmon runs, Alitak Bay District, Kodiak Island, Alaska. Masters Thesis, University of Washington, Seattle.

LITERATURE CITED (Cont.)

Swanton, C.O. and P.A. Nelson. 1994. Kodiak Management Area, salmon catch, escapement and run statistics, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development Division, Technical Fishery Report 94-22 , Juneau.

Tyler, R.W., L. Malloy, D. Prokopowich, and K. Manthey. 1986. Migration of sockeye salmon in the Kodiak Archipelago, 1981. Alaska Department of Fish and Game, Information Leaflet No. 254, Juneau.

Table 1. Estimated age composition of Karluk Lake sockeye escapement by week, post-14 July, 1995.

Week	Sample Size		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	3.1	2.3	3.2	3.3	4.3	Total[a]
29	84	Percent	0	4.5	0	4.6	1.5	8.9	12.3	0	43.3	7.7	17.1	0	100
(7/15-7/18)		Numbers	0	218	0	222	71	427	591	0	2,081	369	822	0	4,802
30	164	Percent	0	3	0	4.1	1.2	9.6	12.7	0.3	43.3	9.5	16.2	0	100
(7/19-7/25)		Numbers	0	400	0	543	161	1,277	1,687	38	5,743	1,257	2,152	0	13,257
31	174	Percent	0	1.2	0.2	4.3	0.6	11.9	12.8	0.6	46.6	9.4	12.4	0.2	100
(7/26-8/01)		Numbers	0	108	14	371	50	1,034	1,110	49	4,052	815	1,077	14	8,694
32	184	Percent	0.1	0.2	0.5	2.6	0.7	10.5	13.6	0.5	45.5	9.7	15.7	0.5	100
(8/02-8/08)		Numbers	4	18	34	188	53	759	986	38	3,297	704	1,138	34	7,252
33	72	Percent	0.9	1	0.2	3.5	3.8	8.1	23.8	0.2	39.4	9.7	9.3	0.2	100
(8/09-8/15)		Numbers	42	45	8	160	177	372	1,094	8	1,815	448	429	8	4,606
34	14	Percent	0.3	5.4	0.1	1.1	1.1	6.3	28	0.1	43.7	7.8	6.1	0	100
(8/16-8/22)		Numbers	6	100	1	21	21	118	522	1	816	146	114	0	1,865
35	185	Percent	0.5	0.5	0.5	2.9	0.7	0.8	63.6	0.4	19.7	9.5	0.8	0	100
(8/23-8/29)		Numbers	444	418	444	2,390	614	692	52,860	307	16,353	7,933	692	0	83,147
36	181	Percent	0.5	0.1	0.6	2.6	0.3	1	61.4	0.1	21.2	11.3	1	0	100
(8/30-9/05)		Numbers	254	53	294	1,302	126	495	30,623	53	10,565	5,661	474	0	49,899
37	188	Percent	0.1	0	0.9	4.2	0.4	1.1	56.7	0	14.5	21.4	0.7	0	100
(9/06-9/12)		Numbers	91	0	627	2,778	268	718	37,876	0	9,709	14,335	450	0	66,852
38	173	Percent	0	0	0.3	1.7	0.1	0.3	50.3	0	14.2	31.3	1.9	0	100
(9/13-9/19)		Numbers	0	0	122	739	61	122	22,311	0	6,284	13,893	822	0	44,353
39	166	Percent	0	0	0	0.1	0	0	57.7	0	10.4	29.9	1.9	0	100
(9/20-9/26)		Numbers	0	0	0	292	0	0	131,871	0	23,691	68,457	4,388	0	228,698
Total[a]	1,585	Percent	0.2	0.3	0.3	1.8	0.3	1.2	54.8	0.1	16.4	22.2	2.4	0	100
		Numbers	841	1,360	1,544	9,006	1,602	6,014	281,531	494	84,406	114,018	12,558	56	513,425

[a] Columns and rows do not total exactly due to rounding.

Table 2. Estimated age composition of Ayakulik sockeye escapement by week, post-14 July, 1995.

Week	Sample Size		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	2.3	3.2	2.4	3.3	Total[a]
29	178	Percent	0	0.6	0.6	12.4	3.4	3.4	25.3	45.5	6.7	0	2.2	100
(7/15-7/18)		Numbers	0	75	75	1,640	447	447	3,354	6,037	894	0	298	13,266
30	170	Percent	0.4	0.4	0.5	10.1	5.2	2.6	25.9	46.9	5.2	0.3	2.7	100
(7/19-7/25)		Numbers	131	152	171	3,641	1,882	930	9,358	16,978	1,899	93	963	36,198
31	176	Percent	0.3	1.1	0	9.2	5.2	2.4	36.7	39.6	5.3	0	0.3	100
(7/26-8/01)		Numbers	72	279	0	2,387	1,337	629	9,486	10,230	1,377	0	68	25,864
32	196	Percent	0	0.6	0	9.1	2.7	2.5	42	36.7	5.9	0	0.5	100
(8/02-8/08)		Numbers	2	77	0	1,234	369	345	5,724	4,992	809	0	68	13,619
33	194	Percent	0	0	0	11.5	1.6	3.5	40.7	38	4.4	0	0.3	100
(8/09-8/15)		Numbers	0	0	0	1,091	156	331	3,866	3,613	419	0	29	9,504
34	197	Percent	0	0	0.1	9	0.8	3.6	37.4	44.4	4.4	0	0.2	100
(8/16-8/22)		Numbers	0	0	19	1,613	148	643	6,683	7,933	787	0	42	17,868
35	197	Percent	0	0	0.5	4.6	0	2	36	50.3	5.6	0	1	100
(8/23-8/29)		Numbers	0	0	22	196	0	87	1,548	2,159	240	0	44	4,296
Total[a]	1,308	Percent	0.2	0.5	0.2	9.8	3.6	2.8	33.2	43.1	5.3	0.1	1.3	100
		Numbers	205	583	287	11,802	4,339	3,412	40,019	51,942	6,425	93	1,512	120,615

[a] Columns and rows do not total exactly due to rounding.

Table 3. Estimated age composition of Frazer Lake sockeye escapement by week, post-14 July, 1995.

Week	Sample Size		Ages 1.1	1.2	2.1	1.3	2.2	3.1	2.3	3.2	2.4	3.3	Total[a]
29	0	Percent	3	0	20.7	0.5	22.2	1	44.9	7.6	0	0	100
(7/15-7/18)		Numbers	218	0	1,487	36	1,596	73	3,228	544	0	0	7,182
30	198	Percent	3	0.4	14	0.3	31.6	0.8	37.9	12	0	0	100
(7/19-7/25)		Numbers	927	119	4,304	95	9,726	249	11,661	3,692	0	0	30,773
31	201	Percent	3	0.8	4	0.2	43.2	0.4	30.7	17.4	0	0.1	100
(7/26-8/01)		Numbers	261	71	352	21	3,782	39	2,689	1,523	0	13	8,751
32	201	Percent	2.4	0.7	2.6	2.3	37.3	0	42.6	11.1	0.1	0.8	100
(8/02-8/08)		Numbers	245	74	268	240	3,813	2	4,357	1,133	12	86	10,228
33	207	Percent	2.4	3.1	2.9	5.7	49.3	0	30.1	6	0.3	0.3	100
(8/09-8/15)		Numbers	101	129	121	237	2,065	0	1,262	253	12	12	4,191
34	211	Percent	5.2	3.3	2.8	6.2	46.4	0	31.8	4.3	0	0	100
(8/16-8/22)		Numbers	70	44	38	83	622	0	425	57	0	0	1,340
Total[a]	1,018	Percent	2.9	0.7	10.5	1.1	34.6	0.6	37.8	11.5	0	0.2	100
		Numbers	1,822	437	6,570	712	21,604	363	23,622	7,202	24	111	62,465

[a] Columns and rows do not total exactly due to rounding.

Table 4. Estimated age composition of Upper Station late run sockeye escapement by week, post-14 July, 1995.

Week	Sample Size		Ages 0.1	0.2	1.1	0.3	1.2	2.1	1.3	2.2	2.3	Total[a]
29	205	Percent	0.5	10.7	0.5	18.5	13.2	5.4	3.4	24.9	22.9	100
(7/15-7/18)		Numbers	3	66	3	115	82	33	21	154	142	619
30	194	Percent	0.1	20.5	0.9	26	11.6	1.8	6.6	19.8	12.7	100
(7/19-7/25)		Numbers	7	1,924	89	2,444	1,089	166	616	1,862	1,191	9,389
31	203	Percent	0.5	30.8	0.5	19.5	17.8	2.3	3	21	4.6	100
(7/26-8/01)		Numbers	34	2,221	35	1,409	1,283	166	214	1,516	334	7,213
32	217	Percent	0.4	20.2	0.4	32.8	13.1	0.9	2.2	28.6	1.4	100
(8/02-8/08)		Numbers	106	5,775	106	9,349	3,736	253	635	8,173	410	28,544
33	5	Percent	0.1	4.5	0.1	38.7	3	0.2	0.5	52.7	0.3	100
(8/09-8/15)		Numbers	34	1,795	34	15,336	1,186	68	203	20,920	102	39,677
34	210	Percent	1.8	11.1	0.9	32.2	13.6	2.3	3.2	32.9	2.2	100
(8/16-8/22)		Numbers	1,141	7,015	553	20,375	8,587	1,443	1,999	20,852	1,403	63,369
35	211	Percent	8.5	9.6	0.5	10.4	12.7	4.8	2.6	48.2	2.6	100
(8/23-8/29)		Numbers	1,555	1,741	94	1,895	2,315	882	474	8,792	477	18,225
36	184	Percent	6.5	8.1	0.5	6.5	11	5.7	3.1	52.9	5.8	100
(8/30-9/05)		Numbers	1,956	2,465	160	1,956	3,329	1,725	926	16,014	1,752	30,283
37	0	Percent	5.4	7.6	0.5	5.4	10.3	6	3.3	54.3	7.1	100
(9/06-9/12)		Numbers	351	492	35	351	667	386	211	3,512	457	6,462
Total[a]	1,429	Percent	2.5	11.5	0.5	26.1	10.9	2.5	2.6	40.1	3.1	100
		Numbers	5,187	23,494	1,109	53,230	22,274	5,122	5,299	81,795	6,268	203,781

[a] Columns and rows do not total exactly due to rounding.

Table 5. Estimated age composition of Uganik Bay (253-11-35) sockeye catch by week, post-14 July, 1995.

Week	Sample Size		Ages 0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	Total[a]
29	0	Percent	0	0	0	5	0.3	0	25.6	12.9	0	0.3	54.3	1.3	0.3	0	100
(7/15-7/18)		Numbers	0	0	0	354	22	0	1,792	907	0	22	3,805	88	22	0	7,012
30	317	Percent	1.6	1.1	1.1	9.1	1.3	0	19.6	21.8	0	0.2	41.5	2.5	0.2	0	100
(7/19-7/25)		Numbers	394	263	263	2,252	322	0	4,875	5,425	0	59	10,335	629	59	0	24,875
31	48	Percent	3	2	3.3	18.4	2.6	0	18.3	30.1	0	0	18	4.3	0	0	100
(7/26-8/01)		Numbers	1,093	729	1,193	6,659	961	0	6,628	10,932	0	0	6,529	1,557	0	0	36,280
32	81	Percent	0.1	0	2.8	17.8	0.9	0.1	28.9	17.7	0	0	27.3	3.9	0	0.4	100
(8/02-8/08)		Numbers	25	0	669	4,237	223	25	6,858	4,214	0	0	6,487	918	0	99	23,754
33	230	Percent	0.3	0.8	3.5	22.2	0.3	0.3	17.1	28.2	0	0	17.9	8	0	1.4	100
(8/09-8/15)		Numbers	70	157	710	4,532	57	70	3,496	5,761	0	0	3,648	1,627	0	279	20,407
34	203	Percent	0	9.5	0.6	21.9	1.7	0	6.1	31.7	0.1	0	7.6	20.2	0	0.5	100
(8/16-8/22)		Numbers	6	3,266	218	7,489	572	6	2,092	10,840	39	0	2,604	6,905	0	179	34,217
35	390	Percent	0	6.2	0.5	22.7	1.8	0	3.9	33.5	0.2	0	5.4	24.6	0	1	100
(8/23-8/29)		Numbers	0	2,938	248	10,695	862	0	1,836	15,764	102	0	2,536	11,581	0	481	47,042
36	498	Percent	0	1.8	0.6	21.8	0.9	0	3.9	37.8	0	0	5.3	27	0	0.9	100
(8/30-9/05)		Numbers	0	177	54	2,124	85	0	379	3,680	4	0	521	2,634	0	88	9,747
37	336	Percent	0	0	0.3	6.5	1.2	0	1.5	58	0	0	4.8	27.7	0	0	100
(9/06-9/12)		Numbers	0	0	2	40	7	0	9	355	0	0	29	169	0	0	611
38	0	Percent	0	0	0.3	6.5	1.2	0	1.5	58	0	0	4.8	27.7	0	0	100
(9/13-9/19)		Numbers	0	0	1	23	4	0	5	205	0	0	17	98	0	0	354
Total[a]	2,103	Percent	0.8	3.7	1.6	18.8	1.5	0	13.7	28.4	0.1	0	17.9	12.8	0	0.6	100
		Numbers	1,588	7,530	3,358	38,405	3,115	101	27,970	58,083	145	81	36,511	26,206	81	1,126	204,299

[a] Columns and rows do not total exactly due to rounding.

Table 6. Estimated age composition of Uyak Bay (254-10-40) sockeye catch by week, post-14 July, 1995.

Week	Sample Size		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	3.1	1.4	2.3	3.2	3.3	4.2	Total[a]
29	0	Percent	0	0.2	0.8	10.8	0.4	25.6	23.7	0.2	0	34	3.4	0.8	0	100
(7/15-7/18)		Numbers	0	12	47	600	24	1,424	1,318	12	0	1,894	188	47	0	5,565
30	473	Percent	0	1.3	1	13.1	0.4	23.9	22.8	0.2	0.2	32.9	3.2	0.9	0	100
(7/19-7/25)		Numbers	26	768	592	7,562	206	13,763	13,116	103	102	18,913	1,855	515	0	57,521
31	0	Percent	0.2	5.5	1.7	22	0.1	17.8	19.5	0.1	0.8	28.6	2.6	1.1	0	100
(7/26-8/01)		Numbers	69	1,805	559	7,178	39	5,800	6,379	20	275	9,329	862	353	0	32,666
32	341	Percent	1.2	7.3	2.7	25	0.5	12.5	20.8	0	0.8	21.8	5.7	1.6	0.1	100
(8/02-8/08)		Numbers	362	2,208	821	7,588	141	3,809	6,335	0	251	6,627	1,746	486	23	30,397
33	468	Percent	1.9	4.5	2.9	17	1	6.8	30.3	0	0.1	14.2	18.5	2.4	0.2	100
(8/09-8/15)		Numbers	503	1,201	774	4,531	268	1,803	8,078	0	39	3,793	4,936	643	53	26,622
34	548	Percent	0.6	1.2	1.3	8	0.6	3.5	38.1	0	0	13.4	30.6	2.3	0.2	100
(8/16-8/22)		Numbers	279	561	607	3,668	291	1,604	17,372	0	5	6,128	13,962	1,066	71	45,613
35	999	Percent	1	1.8	0.8	6.8	0.8	3.7	40.7	0.1	0	5.8	37.3	1.2	0	100
(8/23-8/29)		Numbers	400	700	294	2,617	312	1,415	15,717	29	0	2,225	14,397	475	1	38,581
36	0	Percent	0.4	0.8	0.5	4.6	0.5	2.4	37.3	0.4	0	6.3	45.7	1.2	0	100
(8/30-9/05)		Numbers	176	307	223	1,865	185	957	15,172	159	0	2,544	18,570	494	0	40,652
37	490	Percent	0	0	0.4	3.1	0.2	1.5	35	0.6	0	6.7	51.2	1.2	0	100
(9/06-9/12)		Numbers	2	4	57	427	29	201	4,783	82	0	918	6,996	167	0	13,667
38	0	Percent	0	0	0.4	3.1	0.2	1.4	34.9	0.6	0	6.7	51.4	1.2	0	100
(9/13-9/19)		Numbers	0	0	22	167	11	78	1,909	33	0	368	2,813	67	0	5,469
39	0	Percent	0	0	0.4	3.1	0.2	1.4	34.9	0.6	0	6.7	51.4	1.2	0	100
(9/20-9/26)		Numbers	0	0	2	15	1	7	171	3	0	33	252	6	0	490
Total[a]	3,319	Percent	0.6	2.5	1.3	12.2	0.5	10.4	30.4	0.1	0.2	17.8	22.4	1.5	0	100
		Numbers	1,817	7,566	3,998	36,218	1,507	30,861	90,350	441	672	52,772	66,577	4,319	148	297,243

[a] Columns and rows do not total exactly due to rounding.

Table 7. Estimated age composition of Spiridon Bay Special Harvest Area (254-50) sockeye catches by week, 1995.

Week	Sample Size		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	2.3	Total[a]
30	60	Percent	0	27.9	1.6	34.5	1.6	6.7	16.4	11.4	100
(7/19-7/25)		Numbers	0	490	28	605	28	117	289	200	1,757
31	249	Percent	0	21.1	0.3	52.6	0.9	6	12.9	6.1	100
(7/26-8/01)		Numbers	0	672	9	1,673	29	189	411	195	3,178
32	174	Percent	0	20.2	0	63	0.8	3.4	12	0.5	100
(8/02-8/08)		Numbers	0	539	0	1,678	21	91	320	14	2,663
33	237	Percent	0	21.8	0	62.3	1.8	4.4	9.7	0	100
(8/09-8/15)		Numbers	0	2,306	0	6,602	195	465	1,031	0	10,600
34	184	Percent	0	12.5	0	68.1	1.4	4.2	13.8	0	100
(8/16-8/22)		Numbers	0	866	0	4,710	98	289	951	0	6,914
35	239	Percent	0.1	22.5	0	56.8	3.3	6.4	10.8	0	100
(8/23-8/29)		Numbers	5	894	0	2,254	133	256	428	0	3,970
36	170	Percent	0.5	20.9	0	60	3.5	6	9.1	0	100
(8/30-9/05)		Numbers	13	514	0	1,477	86	147	224	0	2,461
37	0	Percent	0.6	20.6	0	60.6	3.5	5.9	8.8	0	100
(9/06-9/12)		Numbers	1	31	0	90	5	9	13	0	149
Total[a]	1,313	Percent	0.1	19.9	0.1	60.2	1.9	4.9	11.6	1.3	100
		Numbers	19	6,312	37	19,089	595	1,563	3,667	409	31,692

[a] Columns and rows do not total exactly due to rounding.

Table 8. Estimated number of age 1.1 Spiridon origin sockeye salmon harvested in Uganik and Uyak Bays, by week, 1995.

		Uganik					Uyak				
		Number of age-1.1	Visual ID of age 1.1		Catch		Number of age-1.1	Visual ID of age 1.1		Catch	
Week	Date	in sample	number	percent	total age 1.1	assigned to Spiridon	in sample	number	percent	total age 1.1	assigned to Spiridon
30	7/19-7/25	0			263	0	1	1	100.0%	768	768
31	7/26-8/01	2	2	100.0%	729	729	0			1,805	0
32	8/02-8/08	0			0	0	26	23	88.5%	2,208	1,954
33	8/09-8/15	0			157	0	31	25	80.6%	1,201	968
34	8/16-8/22	25	18	72.0%	3,266	2,352	4	4	100.0%	561	561
35	8/23-8/29	28	20	71.4%	2,938	2,098	21	9	42.9%	700	300
36	8/30-9/05	5	2	40.0%	177	71	0			307	0
Total		60	40	66.7%	7,530	5,250	83	61	73.5%	7,550	4,551

Table 9. Classification accuracy, by stock, of age 1.2 scale pattern analysis model.

Actual Stock of Origin	Sample Size	Classification by Stock (percent)		
		Spiridon	Ayakulik	Upper Station (late run)
Spiridon	200	97.0	2.0	1.0
Ayakulik	186	2.7	72.0	25.3
Upper Station (late run	102	2.0	25.5	72.6
		Mean Classification Accuracy =		82.4

Table 10. Estimated numbers of age 1.2 sockeye salmon of Spiridon Lake origin harvested in the Uganik and Uyak catch areas, by week, 1995.

Catch Area	Week	Catch Dates	Sample Size	Stock Composition Estimates (percent)						Catch	
				Spiridon		Ayakulik		Upper Station		total	assigned
				estimate	SE	estimate	SE	estimate	SE	age 1.2	to Spiridon
Uganik											
	30	7/19-7/25	16	31.3	a/					2,252	705
	31	7/26-8/01	31	82.6	16.4	17.4	25.2	0.0	9.8	6,659	5,500
	32	8/02-8/08	31	82.6	16.4	17.4	25.2	0.0	9.8	4,237	3,500
	33	8/09-8/15	31	82.6	16.4	17.4	25.2	0.0	9.8	4,532	3,743
	34	8/16-8/22	46	82.4	13.5	14.8	18.4	2.7	14.5	7,489	6,171
	35	8/23-8/29	46	82.4	13.5	14.8	18.4	2.7	14.5	10,695	8,813
	36	8/30-9/05	71	71.9	12.5	17.8	17.3	10.3	15.6	2,124	1,527
	Area Total									37,988	29,959
Uyak											
	30	7/19-7/25	51	33.3						7,562	2,518
	31	7/26-8/01	50	84.1	12.5	9.0	16.1	6.7	14.6	7,178	6,037
	32	8/02-8/08	50	84.1	12.5	9.0	16.1	6.7	14.6	7,588	6,382
	33	8/09-8/15	52	85.0	14.7	10.0	21.9	5.0	15.9	4,531	3,851
	34	8/16-8/22	30	85.6	20.7	10.0	21.9	4.4	12.6	3,668	3,140
	35	8/23-8/29	46	74.2	16.2	10.0	21.9	15.8	23.5	2,617	1,942
	36	8/30-9/05	46	74.2	16.2	10.0	21.9	15.8	23.5	1,865	1,384
	Area Total									35,009	25,253
Combined Total										72,997	55,212

a/ Visual id method no SE

Table 11. Estimated number of Spiridon Lake sockeye salmon harvested by area and week, 1995.

		Catch Area							
	Catch	Uganik			Uyak			SBSHA	Total Estimated
Week	Dates	1.1	1.2	Total	1.1	1.2	Total	all ages combined	Spiridon Harvest
29	7/15-7/18	0	0	0	0	0	0	0	0
30	7/19-7/25	0	705	705	768	2,518	3,286	1,757	5,748
31	7/26-8/01	729	5,500	6,229	0	6,037	6,037	3,178	15,444
32	8/02-8/08	0	3,500	3,500	1,954	6,382	8,336	2,663	14,498
33	8/09-8/15	0	3,743	3,743	968	3,851	4,819	10,600	19,163
34	8/16-8/22	2,352	6,171	8,523	561	3,140	3,701	6,914	19,138
35	8/23-8/29	2,098	8,813	10,911	300	1,942	2,242	3,970	17,122
36	8/30-9/05	71	1,527	1,598	0	1,384	1,384	2,461	5,443
37	9/06-9/12	0	0	0	0	0	0	149	149
Area Totals									
	Number	5,250	29,959	35,209	4,551	25,253	29,804	31,692	96,705
	Percent			36.4%			30.8%	32.8%	100.0%

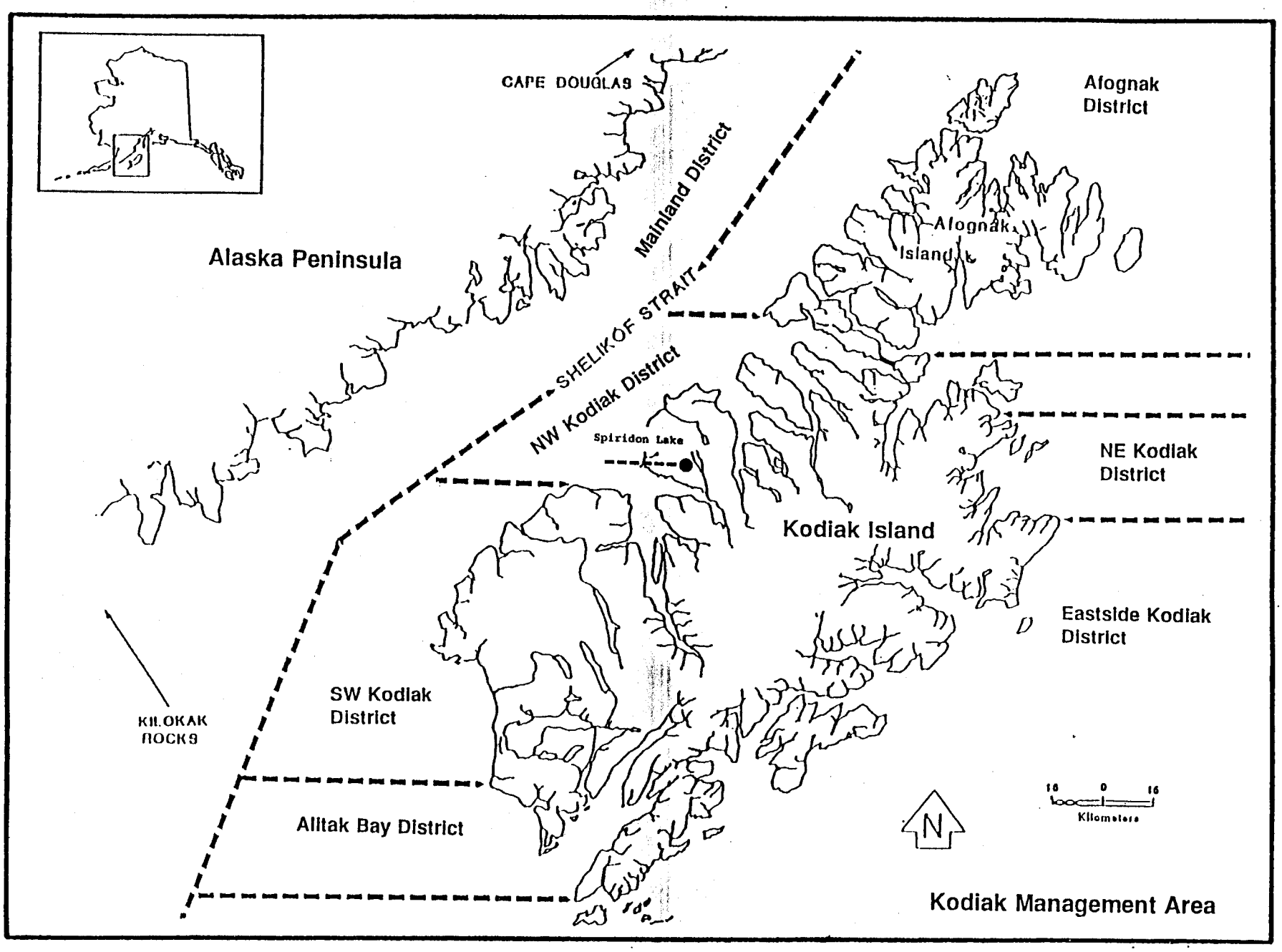


Figure 1. Map of the Kodiak Management Area showing fishing districts and location of Spiridon Lake.

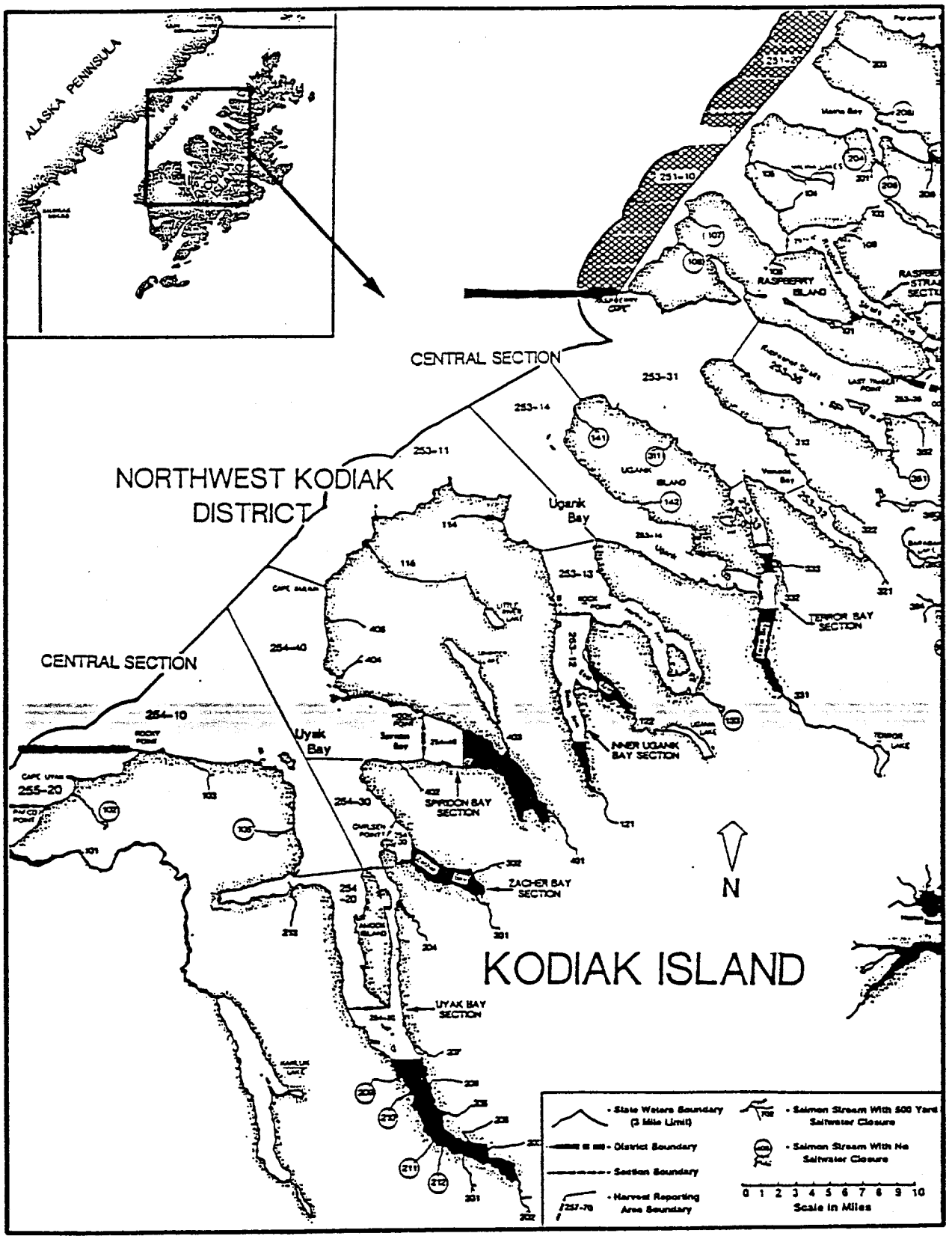


Figure 2. Map illustrating the Central Section of the Northwest Kodiak District, 1995.

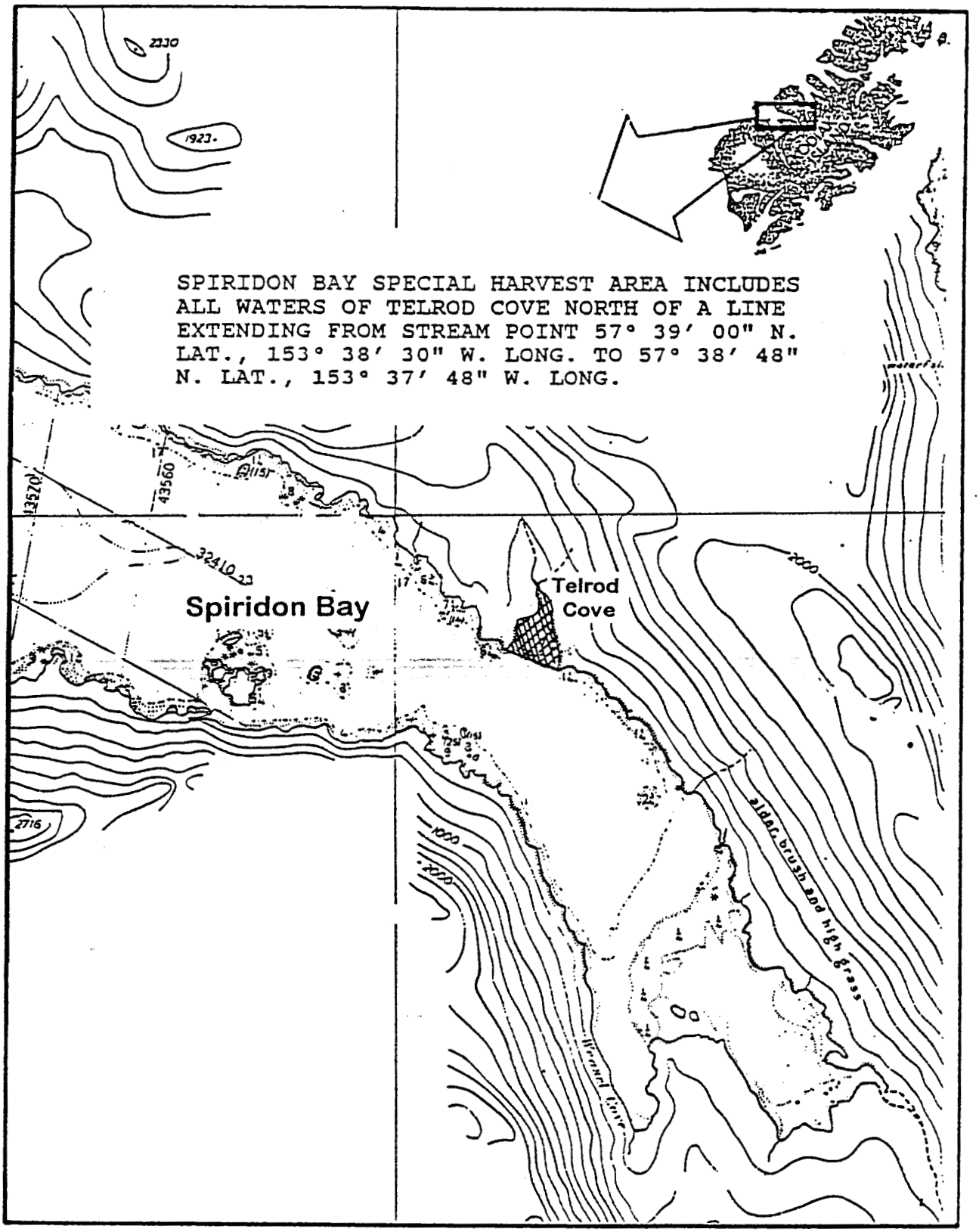


Figure 3. Approximate boundaries of the Spiridon Bay Special Harvest Area (SBSHA) at Telrod Cove, 1995.

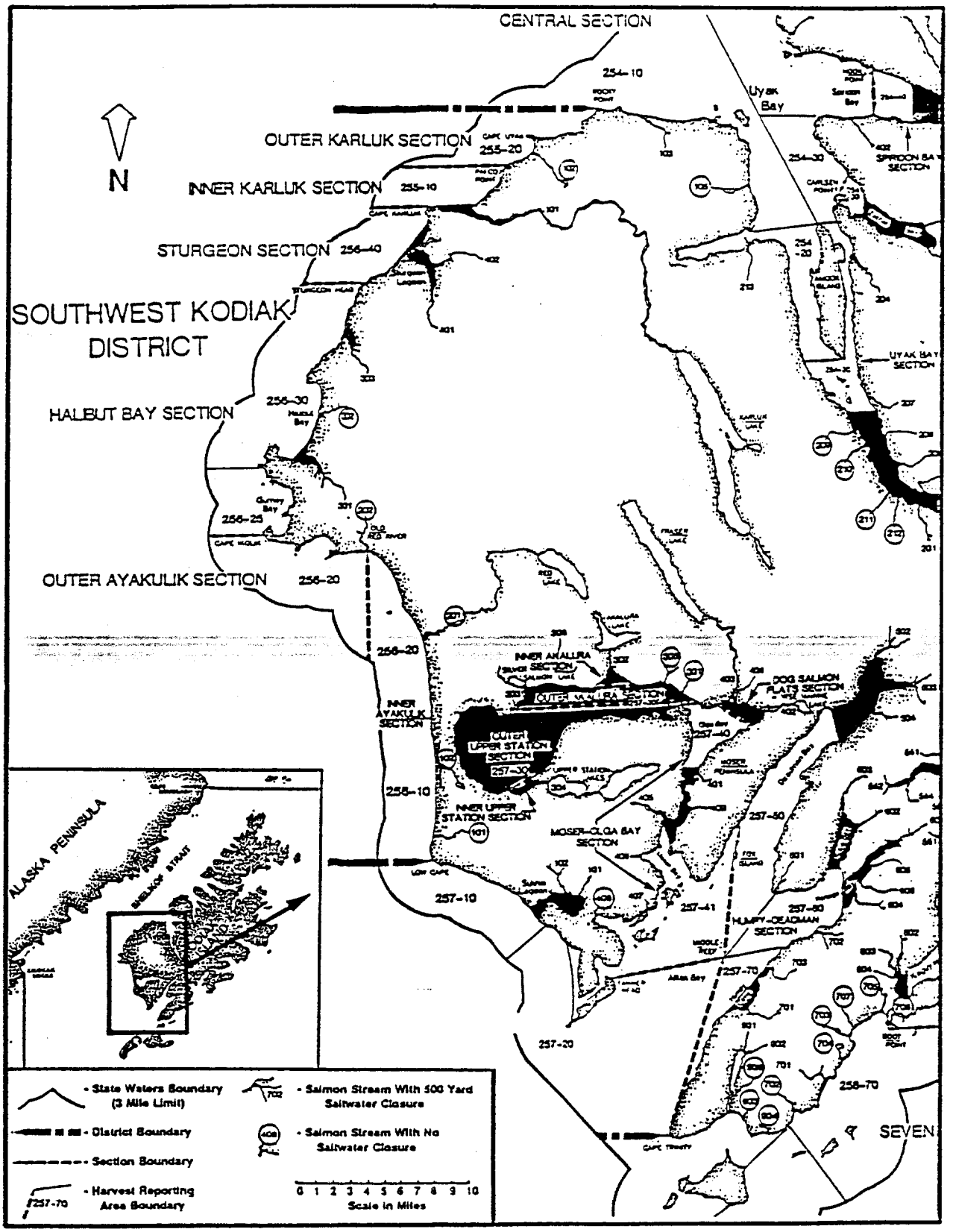


Figure 4. Map illustrating the sections of the Southwest Kodiak District, 1995.

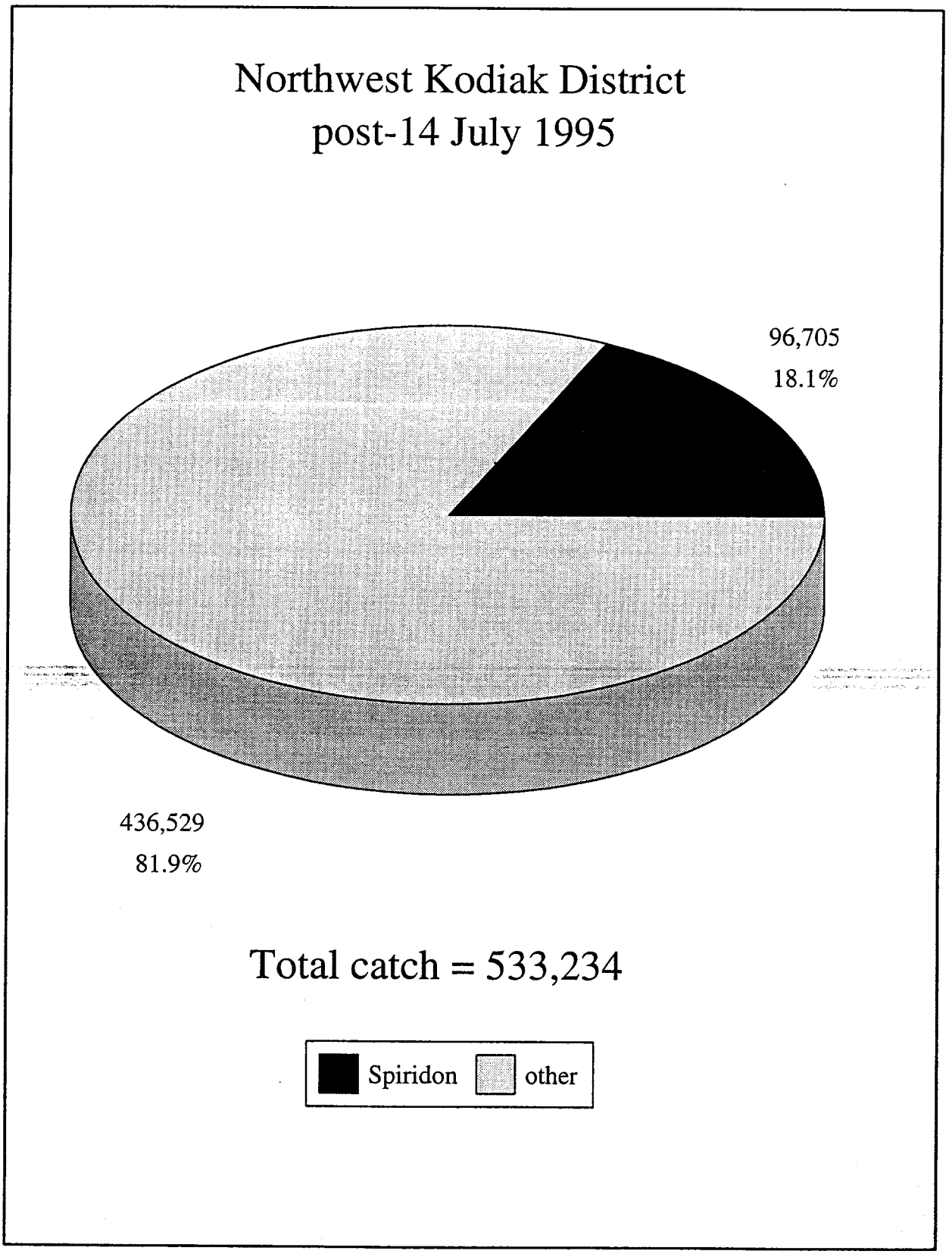


Figure 5. Estimated Spiridon component of the Northwest Kodiak District commercial sockeye harvest post-14 July 1995.

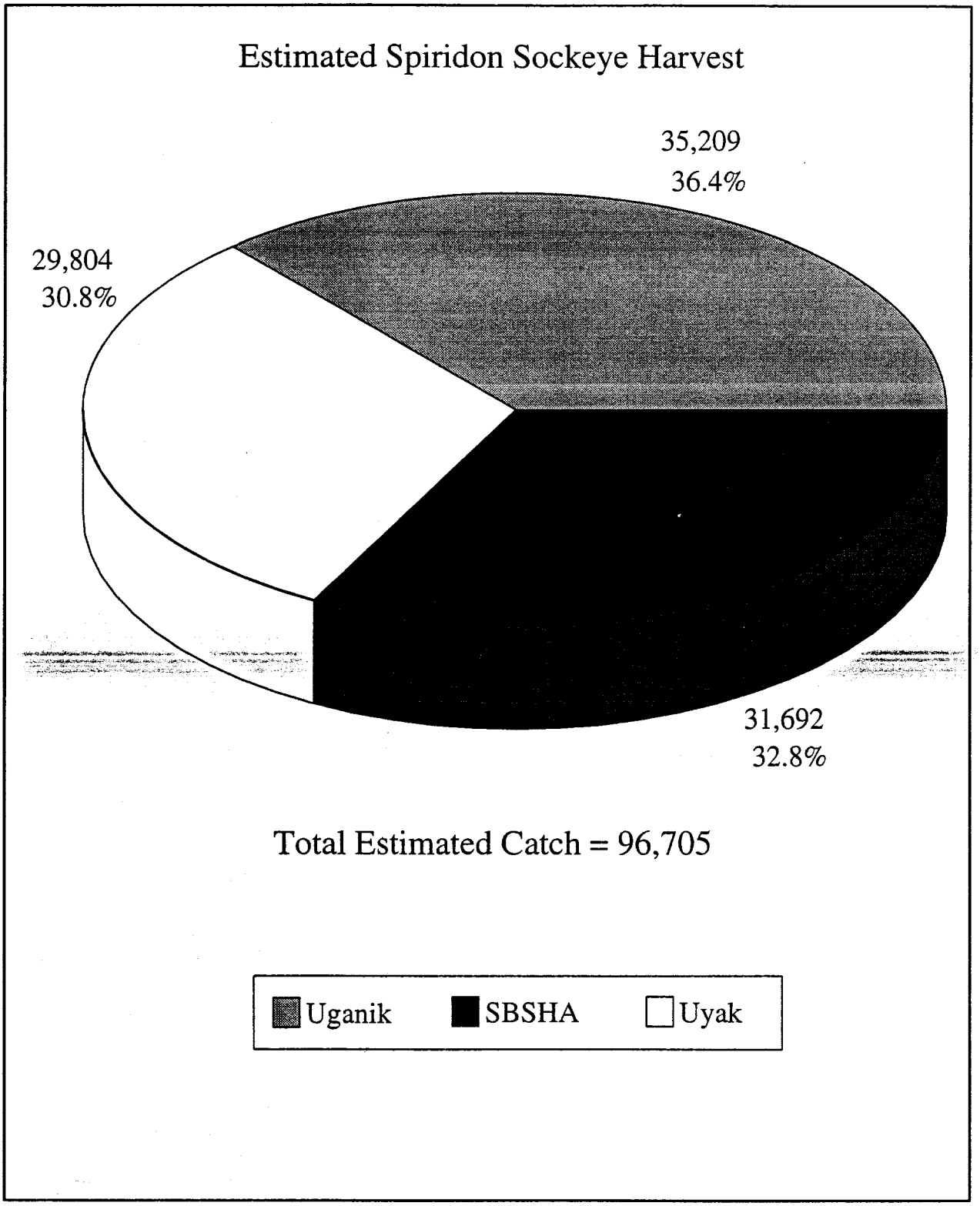


Figure 6. Estimated number of Spiridon sockeye salmon commercially harvested in the Northwest Kodiak District, by area, post 14 July 1995.

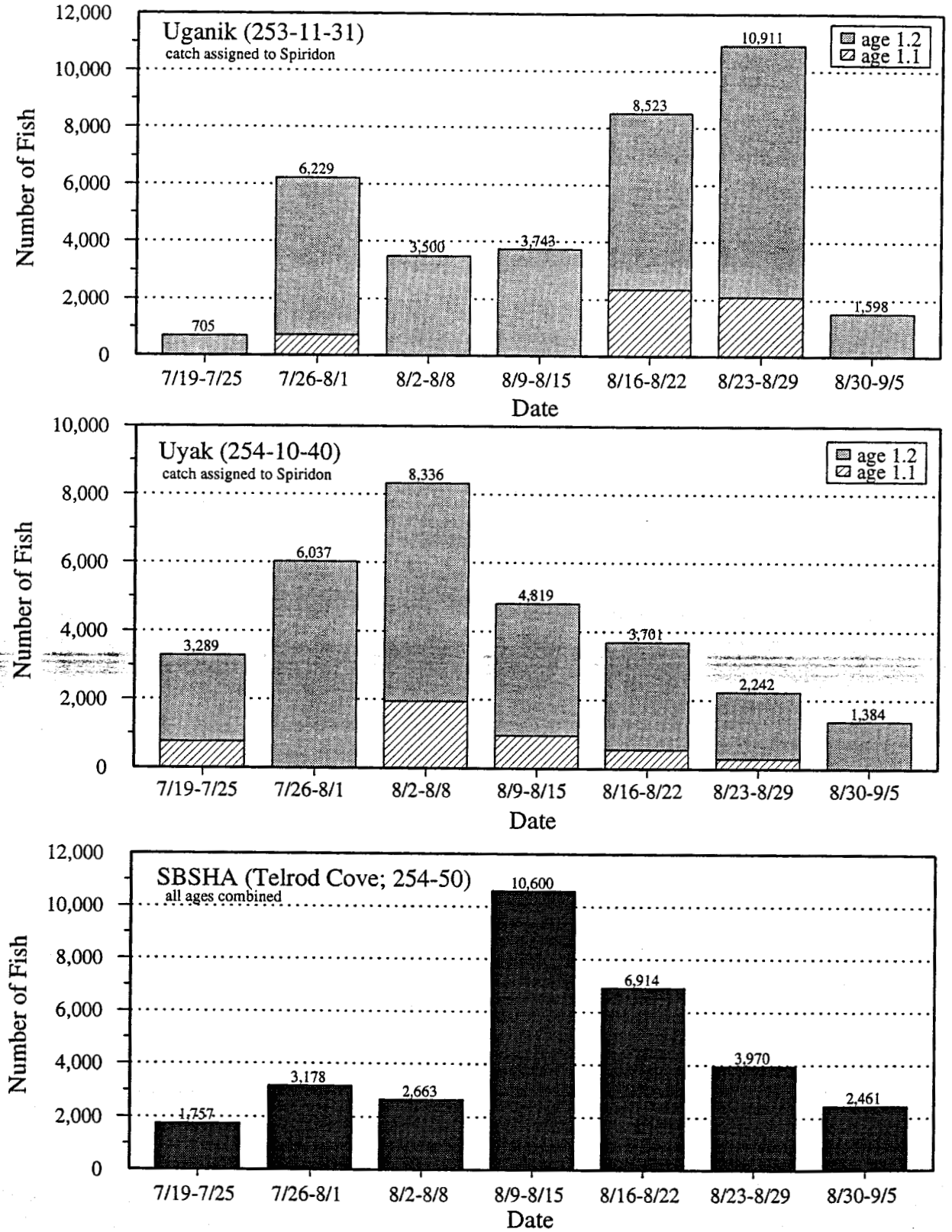


Figure 7. Estimated run timing of Spiridon sockeye salmon by age class and area, Northwest Kodiak District, 1995.

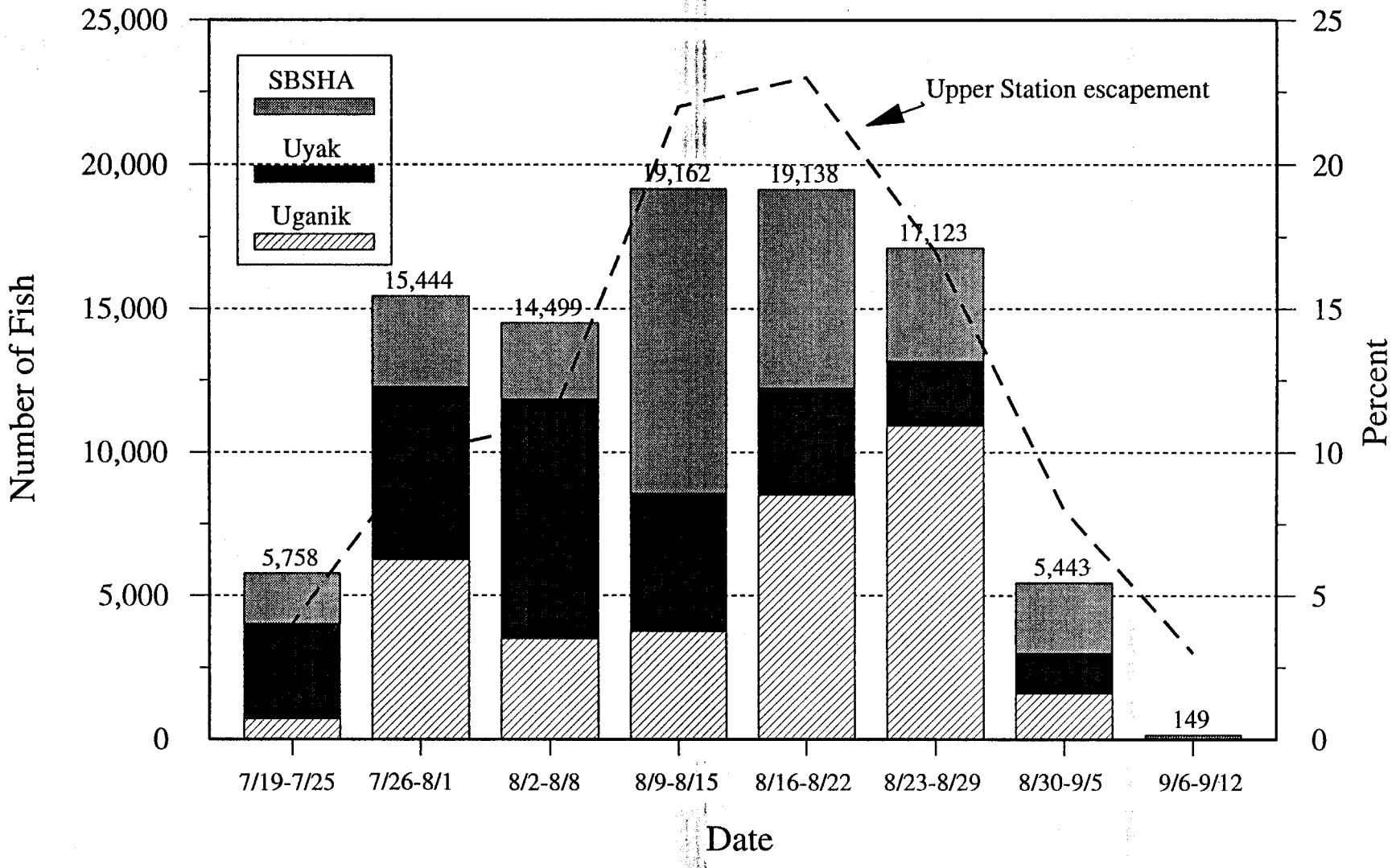
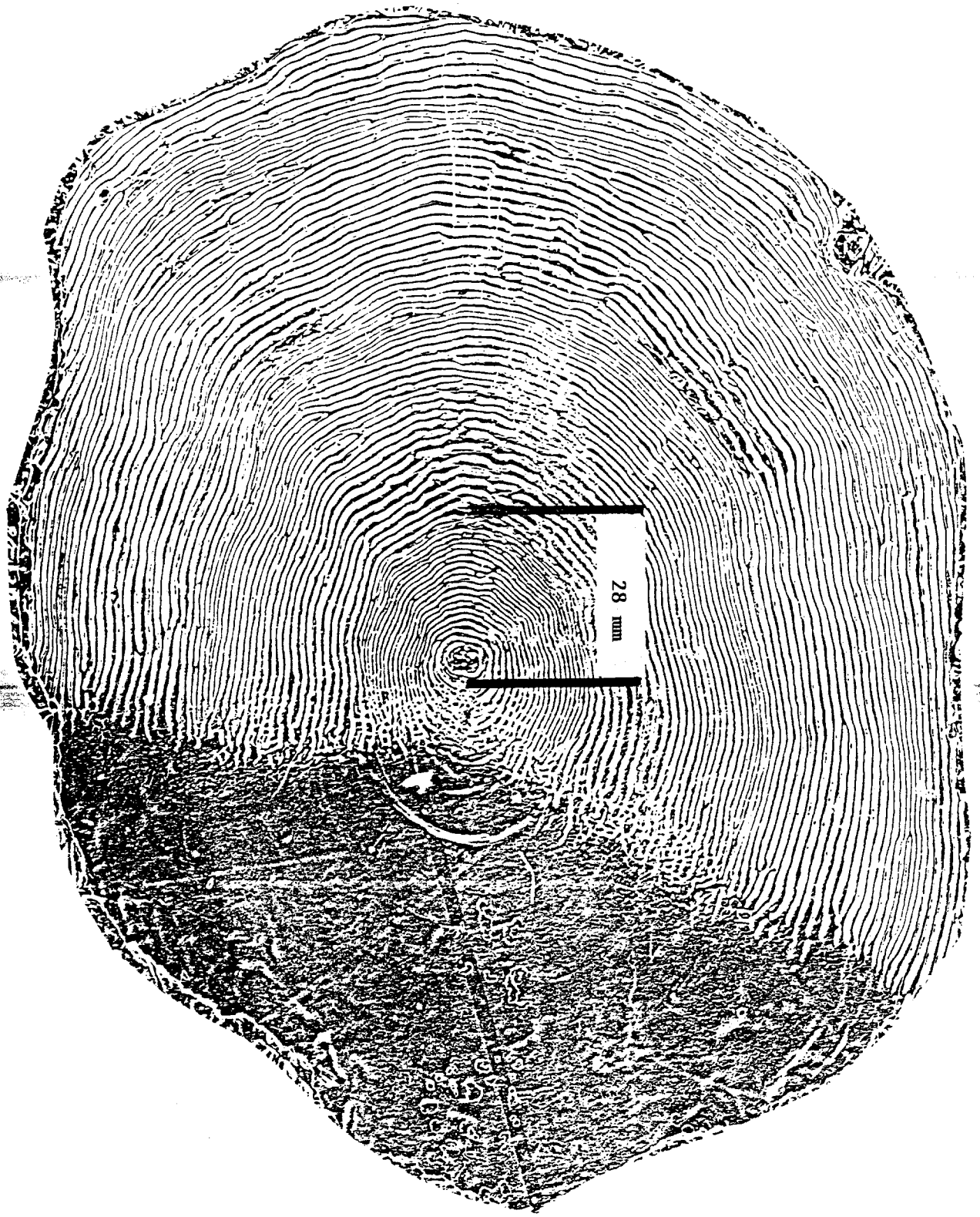


Figure 8. A comparison of 1995 Spiridon sockeye run timing based on harvest estimates and Upper Station escapement timing (10 year average).

APPENDIX

Appendix A. 1. Scale pattern of age 1.1 sockeye salmon collected at Telrod Cove (SBSHA), 2 August 1995.



Appendix A. 2. Scale pattern of age 1.2 sockeye salmon collected at Telrod Cove (SBSHA), 4 August 1995.

Appendix A. 3. Scale pattern of age 1.1 sockeye salmon collected at Ayakulik weir, 6 July 1995.

Appendix A. 4. Scale pattern of age 1.2 sockeye salmon collected at Ayakulik weir, 6 July 1995.

Appendix A. 5. Scale pattern of age 1.1 sockeye salmon collected at Upper Station weir, 19 July 1995.

Appendix A. 6. Scale pattern of age 1.2 sockeye salmon collected at Upper Station weir, 3 August 1995.

Appendix B.1. Descriptive statistics for age 1.2 scale variables from Spiridon, Ayakulik, and Upper Station stocks, 1995.

Freshwater Variable		Stock					
		Spiridon		Ayakulik		Upper Station	
number	name	mean	SE	mean	SE	mean	SE
1	circuli counts	20.0	0.12	12.7	0.14	12.9	0.18
2	1st I.D.	39.1	0.47	39.9	0.45	37.7	0.64
3	2nd I.D.	55.4	0.53	56.3	0.44	53.9	0.73
4	3rd I.D.	71.0	0.56	71.3	0.50	69.4	0.90
5	4th I.D.	86.1	0.60	85.7	0.57	83.7	1.02
6	5th I.D.	100.7	0.65	99.0	0.61	97.6	1.09
7	6th I.D.	114.8	0.69	111.6	0.67	111.4	1.20
8	7th I.D.	128.6	0.75	123.4	0.71	124.6	1.25

Incremental distances for variables 2-8 were measured in .001mm at 200X magnification.